Vol. 73, pp. 267–274 30 December 1960

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

A NEW SUBSPECIES OF THE CLIFF CHIPMUNK FROM CENTRAL CHIHUAHUA

By William Z. Lidicker, Jr.
Museum of Vertebrate Zoology,
University of California, Berkeley

Recent collections made by field parties of the Museum of Vertebrate Zoology from numerous localities in Chihuahua have revealed that the cliff chipmunks (*Eutamias dorsalis*) inhabiting the relatively isolated Sierra del Nido have evolved to the point of subspecific distinctness. Numerous differences exist between the chipmunks of the Sierra del Nido and those representing all other nearby races of *E. dorsalis.* Furthermore, many of these differences are in seemingly unrelated characters so that considerable genetic divergence is indicated. This unique population of chipmunks is formally described below. Measurements were obtained only from individuals which had well-worn molariform teeth.

Eutamias dorsalis nidoensis, new subspecies

Type: Male, adult, skin, skull, and stained baculum; no. 124831, Mus. Vert. Zool., from 5 mi N Cerro Campana, 5600 ft, Chihuahua, Mexico; collected by W. Z. Lidicker, Jr., on 5 July 1959; original no. 1961.

Range: It is known to inhabit the Sierra del Nido complex of high country which includes the Sierra Santa Clara and Cerro Campana as well as the Sierra del Nido proper. Individuals have been collected or observed within an altitudinal range of from 5600 feet to over 8000 feet, although they are most common above 6000 feet. Although these mountains are relatively isolated by surrounding desert and grassy plains, *E. d. nidoensis* probably intergrades with the subspecies inhabiting the Sierra Madre de Occidental to the northwest in the vicinity of San Buenaventura. Its range is separated by about 250 miles from that of *E. d. carminis* in the Sierra del Carmen of Coahuila.

Diagnosis: A sample of 19 specimens from five localities in the Sierra del Nido area has the following diagnostic features. Body size large,

averaging over 134 mm in length (total length minus tail length); tail very short and hind foot moderately short, averaging 92.4 and 34.3 mm in length respectively. Distinctive cranial features include a relatively long maxillary toothrow which averages 5.42 mm in crown length. The skull is relatively broad through the interorbital region, the least breadth measuring from 8.5 to 9.8 mm and averaging 9.09 mm. In contrast to this the breadth across the zygomatic arches is relatively narrow, averaging only 19.90 mm. Moreover, the nasal bones are relatively broad, particularly anteriorly. This is a difficult character to measure adequately, since it is determined in part by the area of the laterally curving portion of the nasals. Nevertheless, this difference was at least partially measured by determining the breadth across both nasals at the junction of the anteriormost process of the premaxillary and the nasals. Nasal breadth measured in this way averages 4.06 mm. See Table 1 for a fuller description of the statistical spread of these measurements.

These chipmunks are, in general, gray with a strong suffusion of whitish hairs, and a dull reddish under-fur color especially in the shoulder region. The dorsal stripes are indistinct. A median black dorsal stripe is always present but it is suffused with whitish hairs, even in summer pelage, so its over-all aspect is indistinct. The pair of brown stripes immediately lateral to the central stripe, often present in this species, is either not present or barely perceptible. Lateral to this area is an indistinct white stripe which is ordinarily visible but tends to blend into the background color. In a few individuals there is an additional brown stripe which is barely visible lateral to this last white stripe. The flanks are similar to the back but have a slight rusty tinge. The facial stripes are dark brown and distinct, and the ventral side of the tail and anal region are a dull rusty color. The winter and summer pelages differ relatively little, although the summer pelage is shorter, slightly less red, and has slightly more prominent dorsal stripes.

Comparisons: This population of chipmunks needs to be compared primarily with that of the Sierra Madre de Occidental, which is now included in the subspecies *dorsalis,* and with *E. d. carminis* Goldman from the Sierra del Carmen in Coahuila. It is these two populations with which *nidoensis* is likely to be closely related. Careful comparison reveals that it is more closely related to chipmunks of the Sierra Madre, than to those of the Sierra del Carmen.

In any discussion of color in chipmunks, it seems pertinent to consider whether or not the specimens being compared are in comparable molt stages. Fortunately the series from the Sierra del Nido consists of some individuals in winter pelage, some in summer, and some in mixed pelage. The various collections from the Sierra Madre also contain all three types of pelage. Color comparisons can thus be made between comparable individuals. The specimens from the Sierra del Carmen were all collected in April and hence are in winter pelage, but comparisons with other individuals in winter pelage seem appropriate.

E. d. nidoensis can be distinguished from *E. dorsalis* of the Sierra

TABLE 1.—Measurements of three populations of *Eutamias dorsalis*.

POPULATION		BODY LENGTH	TOTAL LENGTH	TAIL LENGTH	HIND FOOT LENGTH	EAR LENGTH	CRANIAL LENGTH	MASTOID BREADTH	INTER-ORBITAL BREADTH	ZYGO-MATIC BREADTH	NASAL WIDTH	CROWN LENGTH OF MAXILLARY TOOTHROW	WEIGHT° in grams ♂♂	WEIGHT° in grams ♀♀
Sierra	n	18	16	16	18	18	16	16	18	18	16	18	10	5
del	max.	143	242	102	36	23	38.5	17.4	9.8	20.5	4.5	5.7	67.9	79.2
Nido	min.	122	214	76	31	18	35.9	16.5	8.5	19.5	3.8	5.1	58.3	69.2
	$\bar{x}$	134.2	227.4	92.4	34.25	20.0	37.28	16.83	9.09	19.90	4.06	5.42	62.6	75.4
	$SE_{\bar{x}}$	1.356	2.400	1.958	0.330	0.309	0.195	0.075	0.080	0.071	0.045	0.045	0.997	1.602
Sierra	n	25	23	23	25	25	28	27	28	26	28	28	11	13
Madre	max.	149	253	116	37	23	38.9	17.5	9.5	21.1	4.3	5.7	77.0	95.7
de	min.	109	220	87	34	19	35.5	16.3	8.3	19.3	3.7	4.8	60.0	61.0
Occidental	$\bar{x}$	130.0	233.1	102.7	35.80	21.2	37.02	16.84	8.91	20.14	3.95	5.25	67.6	75.4
	$SE_{\bar{x}}$	1.704	1.723	1.375	0.204	0.268	0.157	0.060	0.066	0.086	0.032	0.036	1.578	3.025
Sierra	n	10	10	10	11	11	11	11	7	11	6	7	1	4
del	max.	142	239	113	36	25	38.6	17.5	9.1	21.0	4.1	5.6	–	69.2
Carmen	min.	123	211	81	31	18	36.3	16.6	8.5	19.6	3.7	5.0	–	56.8
	$\bar{x}$	130.8	222.3	91.5	33.5	21.0	37.28	16.93	8.81	20.27	3.88	5.31	66.9	65.6
	$SE_{\bar{x}}$	2.038	3.073	2.886	0.455	0.714	0.193	0.117	0.112	0.380	0.073	0.084	–	2.950

° Includes all males, and females which are not pregnant or with embryos less than 10 mm in CR length.

Madre de Occidental by a number of skeletal and color features. Table 1 summarizes the information on the skeletal features studied for these two populations and for *E. d. carminis*. For those features which did not seem to show significant sexual dimorphism, values for males and females were combined. As can be seen from Tables 1 and 2, *nidoensis* has a

TABLE 2.—Comparison of populations from the Sierra del Nido and Sierra Madre de Occidental with respect to selected skeletal features.

CHARACTER	n	t-VALUE	LEVEL OF SIGNIFICANCE
Tail length	39	4.44	<.001
Hind foot length	43	4.21	<.001
Maxillary toothrow	46	2.93	.008
Body length	43	2.37	.024
Nasal width	44	2.09	.045
Zygomatic breadth	44	2.00	.053
Interorbital breadth	46	1.72	.095

significantly shorter tail and hind foot, longer body and maxillary toothrow, narrower zygomatic breadth, and broader nasals and interorbital breadth than *dorsalis* from the Sierra Madre. Other measurements studied which did not show significant differences (at least below the 10 per cent level of confidence) are total length, ear length, cranial length, mastoid breadth, and body weight. *E. d. nidoensis* also has less distinct dorsal striping and tends to have a slightly less prominent rusty stripe on the flanks. By contrast, the median black stripe of *dorsalis* tends to be more distinct (less infiltrated with whitish hairs), broader, and more extended anteriorly. Also the first lateral brown stripe of *dorsalis* is almost always more distinct, as is the white stripe lateral to it. Furthermore, the second brown lateral stripe is distinct in about half of the specimens of *dorsalis* and barely perceptible in the rest. These differences hold true for both the winter and summer pelages.

Another possible difference between *nidoensis* and *dorsalis* which may be highly significant is the size of the baculum. Three bacula were available from the series of *nidoensis*. These were cleaned, stained, and stored in glycerin according to the method used by Lidicker (1960) and compared with the descriptions of *dorsalis* bacula presented by White (1953). Measurements were made with an ocular micrometer. White utilized in his description of *dorsalis* nine bacula from specimens of *E. d. dorsalis* including three from the Sierra Madre de Occidental. Although three bacula are not an adequate sample, they are very similar in their measurements in spite of the fact that the smallest of the three is from a slightly younger individual (see Table 3). Furthermore, it is of great interest that they differ considerably from White's sample. In over-all proportions they are very similar except that all three have an enlarged

TABLE 3.—Measurements in mm of three bacula of *Eutamias dorsalis nidoensis.*°

MVZ CAT. NO.	TOTAL LENGTH	SHAFT LENGTH	MAX. WIDTH OF SHAFT	HEIGHT OF KEEL	LENGTH OF TIP	LATERAL WIDTH OF BASE
121743	4.96	4.08	0.37	0.37	1.26	0.67
124827	4.81	3.86	0.30	0.30	1.11	0.67
124831	4.89	3.92	0.37	0.37	1.19	0.89
mean	4.89	3.95	0.35	0.35	1.19	0.74

° For an explanation of terms, see White, 1953.

base which has a lateral diameter of about twice the greatest width of the shaft. There is also a slight medial notch on the proximal end of the base. Apparently neither of these features was present in White's material. In addition, the three *nidoensis* bacula are much larger. They average 3.95 mm in shaft length (instead of 2.64 to 3.69 mm), the greatest width of the shaft (other than the base) averages .35 mm (instead of $<$ .20 mm), and the height of the keel is not quite one-third of the length of the tip (instead of equal to ⅓ or ⅕, see pages 616 and 620 of White). If these differences between *nidoensis* and *dorsalis* should persist when larger samples are examined, they will indicate a distinction which is probably of considerable significance.

Compared to *E. d. carminis*, *nidoensis* has a longer body and tail, slightly longer hind foot, broader interorbital region and nasal breadth, narrower zygomatic breadth, and longer maxillary toothrow. In all four of these cranial features and in body length, *nidoensis* is more divergent from *carminis* than is the *dorsalis* population of the Sierra Madre. On the other hand, *nidoensis* approaches *carminis* slightly in color features. *E. d. carminis* is definitely darker, however, with a dark reddish undertone, and has less distinct dorsal stripes. It also has rustier thighs, a deeper shade of rusty on the flanks, and the facial stripes are broader and more rusty with the white spaces between being a dull gray. All specimens examined had a dark rusty ventral tail stripe which did not overlap in color with *nidoensis* or *dorsalis*. The dorsal surface of the tail is darker because the white tipped hairs are less numerous and have shorter white bands.

In the characterization of *E. d. carminis*, measurements cited by Baker (1956) for four females from two localities in the Sierra del Carmen were added to my figures where the measurements seemed comparable. This served to increase the sample size somewhat for some characters. Unfortunately no bacula were available from this subspecies.

Remarks: The Sierra del Nido population is given subspecific status not only because of the large number of highly significant differences between it and the populations of both the Sierra Madre de Occidental and the Sierra del Carmen, but also because many of the distinguishing

features of *nidoensis* are not intermediate between *dorsalis* and *carminis* thus suggesting that *nidoensis* is not merely a step along a gradual east-west cline. Furthermore, since many of the diagnostic features of *nidoensis* seem to vary independently, they are probably genetically independent (for example the inverse relationship between body length and zygomatic breadth) and a considerable degree of genetic differentiation is indicated. This apparent genetic distinctness is undoubtedly made possible in large part by the almost complete geographical isolation of this population from any other of the same species. Moreover, this isolation was very likely accentuated during the xerothermic period of 4000 to 8000 years ago. In summarizing the differences between the three populations, it seems as if *nidoensis* differs greatly from both *dorsalis* and *carminis* in cranial features, but slightly more from *dorsalis*. On the other hand, it differs more from *carminis* than from *dorsalis* in color features.

It is not within the realm of this report to consider the relative differentiation of the Sierra Madre de Occidental population of *E. dorsalis* with that in adjacent New Mexico and Arizona. Nevertheless, the availability of J. A. Allen's name *canescens* makes some comment on this desirable. His description of *canescens* was based on nine specimens from Guanacevi in northwestern Durango (Allen, 1904). It seems clear from his description that this is the same subspecies as that sampled in this report from the Sierra Madre. To check its relationship to typical *dorsalis*, the color of the Sierra Madre population was compared with that of 11 topotypes of *E. dorsalis* and two near topotypes from adjacent Arizona. No obvious differences were noted. The Sierra Madre population is, therefore, here tentatively considered to be included in the subspecies *dorsalis*.

Specimens examined: All are in the collection of the Museum of Vertebrate Zoology.

E. d. dorsalis

A total of 48 from the following localities: Arizona: Greenlee County: Blue, 6000 ft, 1; Rose Peak, 8700 ft, 1. New Mexico: Grant County: 2 mi W Santa Rita, 6300 ft, Fort Webster (copper mines), 5; 3 mi SW Santa Rita, 6300 ft, Fort Webster (copper mines), 6. Chihuahua: Rio Gavilan, 7 mi SW Pacheco, 5700 ft, 8; Sierra Azul, 12 mi SW Pacheco, 7200 ft, 1; Water Cañon, 7200 ft, 3 mi S Colonia Garcia, 4; Meadow Valley, 5 mi S Garcia, 7500 ft, 1; 9 mi SE Colonia Garcia, 8200 ft, 1; Yaguirachic, 8500 ft, 130 mi W Chihuahua, 8; 7 mi SW El Vergel (= Lagunita), 7800 ft, 1; La Union, 8400 ft, 10 km N Guachochic, 11.

E. d. nidoensis

A total of 19 from the following localities: Chihuahua: Arroyo del Nido, 7000 ft, 30 mi SW Gallego, 6; Arroyo del Nido, 8000 ft, 30 mi SW Gallego, 1; Arroyo Mesteño, 7600 ft, Sierra del Nido, 2; Cañon del Alamo, 7300 ft, Sierra del Nido, 8; 5 mi N Cerro Campana, 5600 ft, 2.

E. d. carminis

A total of 7 from the following localities: Coahuila: 5 mi W Piedra

Blanca, 5000 ft, Sierra del Carmen, 1; 8 mi SW Piedra Blanca, 7000 ft, Sierra del Carmen, 2; 8 mi SW Piedra Blanca, 7500 ft, Sierra del Carmen, 4.

Literature Cited

Allen, J. A. 1904. Further notes on mammals from northwestern Durango. Bull. Amer. Mus. Nat. Hist. 20: 208.

Baker, R. H. 1956. Mammals of Coahuila, Mexico. Univ. Kans. Publ., Mus. Nat. Hist. 9(7): 125–335.

Lidicker, W. Z., Jr. 1960. The baculum of *Dipodomys ornatus* and its implication for superspecific groupings of kangaroo rats. Jour. Mamm. 41(4): 495–499.

White, J. A. 1953. The baculum in the chipmunks of western North America. Univ. Kans. Publ., Mus. Nat. Hist. 5(35): 611–631.